when greater attention is given to the education of the individual along lines which will lead to a better perception of the real meaning of science. Organization and unity of spirit and purpose directed to the scientific education of the public are essential if practical men are to be brought to see that their interests will be furthered by encouraging scientific work and if society is to be depended upon for its liberal support.

Finally, it is an obligation of the botanist to recognize the beneficent influence of personal association. The inspiration gained by participation in the annual meetings of our scientific societies and associations is too well appreciated to need elaboration or comment. Similarly, the importance of the close personal relation between the student beginning research and his instructor is clearly understood. But it is of the possibilities which lie in the closer personal association between the junior and the senior members of this society that I would speak. It is sometimes said that the younger generation is inclined to be dogmatic, self-sufficient and somewhat disregardful of the wisdom and knowledge acquired by their elders. If this be true, it is largely because the printed page has been substituted for the more natural means of communication between individuals. But the printed page transmits very imperfectly the intangible something we call personality, that power to kindle in others the fire of enthusiasm, to develop that point of view which leads to creative thinking, and to point the path to that insight and vision which has been attained by those of riper wisdom. The younger generation needs the personal inspiration and guidance which it is within the power of their elders to give, nay, more, they stand alert and expectant awaiting the time when their natural leaders may signify their willingness to give them counsel and instruction. When the senior members of this society raise the banner of wisdom and experience, and sound the assembly call, they will find their juniors quick to desert the paths which, like those in a woods, end nowhere, or which lead over the heights of purely intellectual gratification, or through the picturesque valleys of individualism, and, rallying to their standard, be content to march together along the broad road of cooperation, and united effort, which ultimately leads to the heights of progress. And then when our leaders shall approach the end of life's journey, they will have the satisfaction of knowing that although their printed works may soon be superseded or sink into oblivion, the influence of their inspiration and personality, perpetuated through their friends and fellow-workers, will endure for all time.

W. W. STOCKBERGER
U. S. DEPARTMENT OF AGRICULTURE

PREMEDICAL EDUCATION

IN Cincinnati on January 17, 1914, a conference was held under the auspices of the faculty of medicine of the University of Cincinnati. Representatives of many medical colleges and of academic institutions had been invited to be present at the meeting and to participate in the discussion upon what has been called, very widely, "premedical education." The object of this conference was to draw together the academic and medical institutions for the sake of more satisfactory preparation of students for medicine.

In opening the conference the chairman spoke as follows:

In a lecture to his students in 1821, Dr. Graves said that the practise of medicine can not be taught or learned by hearsay. Later in his introductory lecture at the opening of the session of 1837–38 he enlarged upon his former remarks, and said: "No profession requires a sounder preliminary education than ours, and in none ought education to be more studiously directed to promote

the activity and development of the mental powers, especially those connected with the habit of observation as well as with the judgment and memory.'' Dr. Graves realized the importance of individual judgment which must be based upon trained observation, and the dangers of the memory method which is always founded on authority. He was interested in premedical education.

This conference has been arranged for the purpose of centering your attention upon the problems of medical education, and especially of premedical education. It is evident to those of us who are medical teachers that if we are to keep medicine what it is said to be and what often it is not—one of the learned professions—we must have the assistance and the active cooperation of the colleges of liberal arts and sciences. It is to the colleges of arts and sciences that we must look for sound preliminary education for medicine.

For exercise and development of the powers of observation the sciences, physics, chemistry and biology, are most important. The laws of these are constantly applied during the whole life of the physician. Without them the study and practise of physic becomes an affair of memory instead of being one of reason. More and more the problems of medicine are coming to be chemical problems—biochemical, if you please. Biochemistry is the chemistry of the tissues and fluids of the body. These materials belong to that comparatively new class which we call colloids which are investigated most satisfactorily by physico-chemical methods. Physics and chemistry are therefore the basis of the study of the phenomena of life. There is not room in the medical curriculum for these subjects. They must belong in the premedical years—to the courses in colleges of arts and sciences, and in such colleges they must be thoroughly studied in laboratory courses. They can not be studied in lecture courses. We therefore wish to discuss the matter of satisfactory courses in physics, chemistry and biology.

It is almost unnecessary to say that with this science training, language work should not be neglected. This is especially true of English. Many of our otherwise well-trained students are deplorably ignorant of their own language. They need German and French, to be sure, but they need to be able to use their mother tongue. We wish to discuss the matter of English, German and French.

So much for the subject matter of premedical courses.

The quality of the students is just as important. The medical schools of the first grade are interested in teaching a few good students, not in teaching large classes. The United States is already overstocked with doctors. It needs no more physicians, but it needs better ones. The influence of these facts is shown already in the attempts of certain schools to limit the number of students in their classes. With good students in small classes we expect to obtain better results than we could possibly expect even with good students in large classes. Mass teaching is never successful.

Small classes of good students in medical schools will be useful in another direction. The teaching will improve. The colleges of arts and sciences can affect the character of medical teaching by sending only well-prepared students to medical schools. Good students are critical and teachers are very susceptible to criticism.

So, for the good of both colleges of arts and sciences and of medical colleges, a cooperative arrangement should have the greatest value, and such an arrangement should ultimately affect to a considerable extent the whole medical profession and, through it, the general public.

There is another important aspect in this proposed closer association of medical schools and colleges of arts. You know that, as a rule, the state standards for practise tend to lag behind—to be influenced by medical schools of the lower grades. If the colleges of arts will let it be known to their students that without two specified premedical years in college science they can not practise in the Dakotas, in Iowa, in Minnesota, Colorado, Indiana or Kentucky—that is to say that certain states will not consider them sufficiently well-educated to practise—the colleges themselves will be benefited; the medical schools will be helped; the schools of a low grade will be embarrassed, and the state boards will be stimulated to be more active in enforcing standards which will make it more possible to protect the public from the half-educated doctor.

I hope that at this conference we may be able to come to some understanding which will make it possible for us all, and for others who are not here to-day, to work toward the ends which I have suggested. It is for the benefit of all the people that we are working. The people are subject to ill-prepared doctors; they are preyed upon by quacks and charlatans. ''The higher the standards of education in a profession, the less marked will be the charlatanism.''

Following these remarks a series of short prepared papers were devoted to the methods

used and the scope of "premedical" courses in biology (Professor Guyer, of Wisconsin), in chemistry (Professor Jones, of Cincinnati), in physics (President Ayres, of Tennessee) and in modern languages (Professor Brandon, of Miami). Following these papers the meeting was opened for general discussion in which many members of the conference took part.

The gist of the discussion appeared to be that certain preliminary work was necessary for medicine, and that certain other preliminary work was advisable. Furthermore, it seemed that the necessary work should lie in biology, physics, chemistry and a modern language, preferably German; that a substantial enough knowledge of these sciences could not be acquired in a single premedical year; and that while it might be acquired in two years of college work, no time was allowed in a two-year course for various studies, such as psychology, logic, economics and other advisable subjects. Also, it was said that even at the present time the average age of graduation in medicine was about 27.5 years, and that there was evidence of wasted time somewhere. Again it was urged by some members of the conference that a sharp uniformity of preparation was not a wise thing to accomplish, but that some latitude should be allowed in preparation, provided only that students who intend entering upon the study of medicine should be well equipped with a working knowledge of the fundamental sciences, and enough of the humanities to insure breadth.

Before adjournment a resolution was adopted and sent to every college represented at the conference. Later other colleges and even a few individuals were included in the list. The resolution follows:

In view of the ideas expressed in this conference,

Be it Resolved, That the representatives of the various colleges confer with their respective faculties to ascertain:

1. What courses of a premedical nature are offered by them in chemistry, physics, biology and languages.

2. What changes, if necessary, can be made to establish uniformity of essentials in premedical training.

3. Whether it is possible to reduce the total time now required to obtain the M.D. degree, by eliminating duplication of work existing in graded schools, high schools, colleges and medical schools. Your committee is of the opinion that this is feasible.

4. What arrangements are made for granting the bachelor's degree after satisfactory completion of two or three years' college work and one or two years in a Class A plus medical school, and,

Be It Further Resolved, That the action taken by the various faculties be reported to Paul G. Woolley, University of Cincinnati, chairman of the general conference committee, for tabulation, and that this committee may, at its discretion, call another general conference of the colleges interested in this movement.

(Signed) M. F. GUYER, *Chairman,*
HARRY H. HOLMES,
LAUDER W. JONES,
HENRY MCE. KNOWER,
E. L. RICE

By the time that the resolution was ready to be mailed a communication had been received from Professor Holmes, of Earlham College, which it seemed might furnish an excellent basis for faculty and departmental discussion. Accordingly, Professor Holmes's letter was embodied in a communication sent to each college. This letter was as follows:

My Dear Sir: The following remarks have come from Professor Holmes, of Earlham College, who was a member of the Cincinnati Conference on Premedical Education. It seems to me that these suggestions furnish a very thorough basis for the discussion of Premedical Courses in Colleges of Arts and Sciences.

"I want to suggest that our committee (or yours) map out a fairly definite three years' course of college work and persuade a large number of colleges to grant the degree of B.S. or A.B. on the satisfactory completion of this and one year's work in a 'Class A Plus' medical school. It does not meet the situation to arrange this unless nearly all the work is rather strictly outlined. Three years of general elective work could be a very poor preparation for medicine and the whole effect could be a hodge-podge not deserving the A.B. or B.S. degree. We must have a consistent major *medical and premedical,* for this period.

"The present 'Class A Plus' requirements of only two years college work, even though certain needed subjects are specified, cuts short the foun-

dation of chemistry so desperately needed in medicine, permits of but one modern language (because of limited time), and yet both German and French are required at Johns Hopkins and needed everywhere, and if the student attempts to take both chemistry and biology during these two years he can carry physics only at the expense of loading with three sciences at the same time—questionable in college. This plan doesn't allow for general culture.

"How much better to have the student of medicine splendidly prepared in all the fundamental essentials of his profession by three years in a college atmosphere with a little time for broader culture. Many who are not willing to spend four years for a college degree or three years as indicated would do so if they were to be rewarded with such a degree after the first year in the medical school. The standard of medicine would be raised and colleges themselves hold their students longer than at present. A few who now take four years might stop with only three, but this would be more than made up by the two-year students who remain for three years.

"Of course the state universities and some others have an arrangement for granting the B.S. to *their own men* after three years in college courses and one in their own medical school but what we need is a uniform standard for a large number of colleges, a standard that forces full training in the essentials. We save a year and gain much.

"Since I am not a biologist, I leave the details of that subject to be filled in by the rest of you. The laboratory time is measured, not by any credit system, for that varies, but by actual required periods of work. The electives possible should not be permitted in science or mathematics. This insures a broader training. If we get a score or more colleges to agree to this arrangement we may persuade the American Medical Association to publish a list of 'Class A Plus Pre-medical Colleges.' Why not?"

The following is Professor Holmes's schedule of the three years' work:

FIRST YEAR

Chemistry, General:—At least 72 hours of lectures. At least 144 hours of laboratory.
Physics:—Same as chemistry.
German:—At least 144 lectures.
Mathematics:—Algebra and trigonometry, at least 72 hours.
Rhetoric:—At least 72 hours.

SECOND YEAR

Chemistry:—Must include some qualitative and quantitative analysis. At least 72 lectures and 144 hours laboratory.
Biology:—Similar to chemistry.
German:—At least 108 lectures.
Elective:—108 hours outside science and mathematics.

THIRD YEAR

Chemistry:—Must include organic: lectures, 72; laboratory, 96 hours; any other chemistry laboratory, 48 hours.
Biology:—Similar to chemistry.
French:—144 hours.
Elective:—108 hours outside science and mathematics group.

Note.—Hours refer to the entire year. The above is merely the minimum and in many cases could be increased slightly.

The results of the correspondence are interesting, not so much because so many institutions responded, as on account of the nature of the responses. As is usual in such instances those who were really interested continued the discussion, the uninterested dropped it. This again is of interest because evidently from the letters, there are some very much needed reforms.

One institution took faculty action on the resolution, and returned the following:

Be it resolved, etc.,

1. That we are glad, in so far as it is possible, to arrange our courses in biology, chemistry and physics so as to meet the admission requirements of the best medical colleges. That we are now doing this is evident from the fact that our graduates are readily admitted to the medical school of Johns Hopkins University.

2. That we will cooperate with the medical schools in every way practicable to eliminate duplication of work in college and medical school whenever such duplication exists.

3. That we do not regard a year in a medical school as having the same purpose or being in any sense equivalent to the senior year in college; that we regard the two fields of education as essentially different and distinct. We are therefore opposed to any plan whereby the bachelor's degree shall be given upon the completion of less than four years of college work.

One would only remark in commenting upon

this resolution that it all depends upon what the senior year is devoted to, whether it is or is not equivalent to a year in medical school. The senior year at Purdue in the course leading to the "B.S. in Science" is the equivalent of a medical college year and not "essentially different or distinct." Also, one might suggest that the meaning of equivalent should be stated if the paragraph is to be forceful. Moreover we shall point out later, the main difficulty in duplication is not between college and medical schools, but between college and high schools.

Other responses have come from presidents of institutions. Between these there is a world of difference. One is as follows:

The National Educational Association has a committee out on this question [reform of the whole system of public schools]. It would be undesirable for the medical schools to take any definite action in conflict with the recommendations of this committee, or with the action of the N. E. A. I think that the best we can do at the present time is to accept the public school system as it is and build on it. Referring to the recommendations of Professor Holmes, of Earlham College, I beg to say that I do not believe that it is desirable to attempt to tie down colleges as to the character of their work for their degrees; I think the colleges would resent any attempt to impose such uniformity on them. I think, further, that the consensus of opinion at our conference, including the opinion of Dr. Welch, was that such stereotyped uniformity was undesirable. No two men would probably agree on exactly the relative distribution of time between the various subjects, or on the most desirable choice of subjects themselves. I, therefore, think it will be wise to keep out of the way of such complications and difficulties that would beset us if we attempted such uniformity.

The writer of this letter misunderstands Professor Holmes schedule, which was suggested as the form of a course. In carrying out such a scheme no limit is placed upon the individuality of teacher or student. The "relative distribution" of time is one thing, the essentials of premedical teaching is another. There is a *least* time in which the essentials can be covered by the average student and the schedule is made for the average. Allowance is always, I hope, made in colleges at least for the brilliant students for whom no schedule can ever be made.

Another presidential letter follows:

I will answer first the questions formulated by your committee.

1. We offer everything required in the regular premedical course, that is, we fulfill the two-year requirements of the American Medical Association and besides this have just adopted an agreement with Western Reserve Medical College for a combination course—three years at our own school and four years at Cleveland.

2. I believe that the only way in which uniformity of essentials in premedical training can be obtained is by the adoption by the American Medical Association of standard requirements for a three-year course. Our faculty believes that the course suggested by Professor Holmes, of Earlham College, is an excellent one with possibly one or two minor additions. We are, at present, giving everything in this course and should be glad to publish in our catalogue a regular three-year premedical course if sanctioned by the Medical Association.

3. Our faculty believes that duplication of work is practically unavoidable in view of the quality of teaching done in certain secondary schools in the country. We believe that the best way to get efficient teaching in these schools so that work done there need not be duplicated in college is to increase considerably the requirements for those who wish to teach in such schools. Our idea is that the present system of examination required of teachers in many subjects tends to an unwise dissipation of energy on the part of the candidate. We should advise much stricter requirements in that particular line in which the candidate wishes to teach, with a thorough examination, and, at the same time, elimination of a dozen or more odd subjects now required in Ohio teachers' examinations. We believe that this method would make for the securing of well-prepared specialists in the various departments of secondary schools.

4. As stated above, we have made formal arrangements for a combination course only with Western Reserve Medical School. We are, however, prepared to enter into the same combination with any school in the A plus class of the American Medical Association. Our requirements are: Three years spent in residence at . . .; the pass-

ing of at least 96 semester hours of work here, with a total of 128 hours for graduation; also the completion of the necessary major and minor requirements in any of the courses laid out in our catalogue. If these conditions be satisfied, we will give a Bachelor's degree to students in combination course after one year's work in an A Plus Medical School.

I proceed now to answer your second letter containing the course of study proposed by Professor Holmes, of Earlham College.

I may say at the outset that our faculty is heartily in sympathy with Professor Holmes's ideas and believes that the establishment of a definite premedical course with a list of approved premedical colleges would be of extreme value.

As stated in answer to your first letter, we are perfectly willing to adopt combination courses giving a college degree after three years spent with us and one year in an A plus medical school, provided that the student has three years of residence in . . .; passes 96 hours of work here and a total of 128 hours for graduation and provided also that he fulfills the major and minor requirements of one of our regular courses. We already have made such an arrangement with the Western Reserve Medical School.

Our faculty begs to signify its approval of a three-year schedule as submitted by Professor Holmes with the following suggestions: That the various colleges be allowed a certain latitude as to the year in which certain subjects are given. Our courses in physics, for instance, are not open to freshmen and could not be taken in the first year. Possibly a general statement of requirements in each subject would meet more general approval than a definitely laid out program year by year and would allow various colleges a little more latitude in arranging courses. Our faculty is also unanimous in its feeling that at least 108 semester hours of psychology should be required in every premedical course, since this subject is practically indispensable to a well-equipped medical man of to-day.

With the above suggestions, we are heartily in agreement with the proposed plan and are willing to adopt it should it receive the sanction of the American Medical Association.

In this letter the quality of teaching in the secondary schools is mentioned. This I shall comment upon later. I wish, however, at this point to emphasize the method suggested for improving the teaching ability and therefore the quality of the teaching in secondary schools. The question of psychology is also touched upon. Certainly a course in psychology should be a prerequisite for graduation in medicine. Without it there is little value in courses on mental diseases, but any introductory course should be supplemented later by a brief course in experimental psychology, and, for those who desire to go more deeply into psychiatry, a thorough course should be offered.

Among the letters which have been received, there are two from deans which deserve quoting. The first begins with an outline of the work offered for the degree B.S. It then says:

> We have had one case granted the privilege of being absent during the senior year, counting the work of the medical college as equivalent to our senior work. It did not appeal to us very strongly for several reasons. First, the difficulty of getting the reports of standing at proper times and controlling thesis work. This, of course, was a minor difficulty, but none the less annoying. Second, was the fact that high-grade students are not as a rule interested in such a scheme. With us it has apparently applied to an unstable group of students, restless under university restrictions and apparently constitutionally unable to remain in any institution for more than a year or two. Such men are neither good representatives of the college from which they go nor desirable candidates for the medical college in which they matriculate.
>
> May I suggest another possible solution? Suppose we realize that four years is not a divinely appointed length of time for either baccalaureate or medical degree. Suppose we recognize the fact that the degree represents a definite amount of work satisfactorily done. Suppose that we also allow men of sufficient mental strength, industry and eagerness to do the work in three years, either in the college or in the medical school. If this were done, would not the same, if not a better, result be reached? Certainly high-grade men would be rewarded for their ability and industry and a short cut to two degrees would not be offered to all sorts of candidates. Whether in university or in medical college there seems no good reason why a man should not have one or two ways of obtaining credit, either by taking the subject or by examination.

As it stands, all of our courses of study are arranged for the average man, and the average intellect of five hundred people does not come very high. An easy inference is that many bright men, both in the university and in the medical college, are merely marking time. A method such as I suggest has nothing against it save the sanctity we have thrown around the four-year idea of the amount of work required for a degree. If requirements for a degree were measured in quantity and quality of work, instead of in time, many of the difficulties of which we complain would disappear.

I have no sort of objection to the plan as outlined. It is substantially that put in practise in 1895 by a number of institutions maintaining premedical courses by private arrangement with medical colleges. I will present the communication to the faculty for consideration and action, but I doubt if we would care to advertise a three-year-in-and-one-year-out-degree. That a baccalaureate degree should not be given for work done in absentia is almost a necessity if the degree is protected.

A scheme which will give the man of exceptional ability a chance would appeal to me. At present our educational systems favor the average man and penalize the exceptional man. We spend too much time trying to put a polish on a buckeye which should be given to mahogany. However, count on me to attempt to put anything through the committee agrees upon. I feel it is about time we are getting down to fundamentals in this joint between university and professional schools. If the fundamentals are not such, then what I have said is without significance; but being in close contact with medical and university education makes me absolutely certain that any attempt to shorten the time before the degree of M.D. can be secured, by elimination of English and other cultural studies, is basically wrong and foredoomed to failure.

This letter is to me an exceptionally strong one, for I feel that it hits the nail exactly and evenly on the head. The "divinely appointed length of time" occupied in the various divisions of an individual's educational career needs consideration. Let us by all means measure a man first by the quality of his work, and second by the quantity, and then help him in the way he should go, and if he deserves it, if he is mahogany—polish him; if he is a nut—give him what polish we can spare from the finer work, or plant him in another soil.

The second letter that I wish to quote in this connection is from a medical dean of a university where two courses are offered in preparation for medicine, a one-year and a two-year course, the latter leading with additional medical years to the degree B.S. This letter says that when conditions change, they in that university are prepared to make a rearrangement which will, the dean believes, be an improvement. And further,

The most serious problems with us arise from the inefficiency of the high schools, especially in the elementary science and language courses. So few of our high schools (and I think the conditions are essentially the same throughout the greater portion of the South) give acceptable courses in science and modern languages that for practical purposes they may be left out of consideration. The result is that the college courses must necessarily be more elementary in character and of lower grade than they otherwise should be. A course in general chemistry, for instance, arranged for students who have had in the high schools an elementary course in general chemistry with laboratory work would be of a much higher grade than a course arranged for students without such preliminary training. So long as this condition exists there will be very little improvement in "chemistry 1" or "zoology 1" or "physics 1." The weak elementary courses strike at the foundations of a sound science training and so long as chemistry 1 is weak, chemistry 2, 3 . . . x will not be all that we expect of them. The problem with us is therefore the strengthening of chemistry 1.

In the absence of adequate high school courses one obvious remedy is the introduction into the college curriculum of a group of elementary science courses supplementary to the high school course. This has been done in the modern language department here. Such an alternative will necessitate an additional "college year" which for many reasons is objectionable. The college should do less rather than more of the high school work.

This letter calls attention to the fact that high schools offer courses in physics, chemistry and biology, and that they offer incomplete courses, which, however valuable they may be to the individual who is not going to study medicine, waste the time of the one who

is going to. The remedy is obvious. The high school should limit its incomplete scientific work for the many who do not expect to follow scientific courses in college, and either offer complete courses for those who do expect to do scientific work, or leave the introductory science to the college. Such a program would mean a certain amount of individual work along the lines of vocational guidance, a thing which is being done more and more in preparation for the trades, and with excellent results. It has not been applied to the professions. As the age of graduation has increased it has become evident that some method must be devised which shall save the time of the student in order that he shall be prepared for his life work before he reaches senility. I have already called attention to a possible method of applying guidance methods to premedical students in high school and grammar school, but so far as I know the experiment has never been made.

There is a method which might be used certainly in college and even in high school. My attention was called to it by my colleague, Professor Fischer, who designated it as the Missouri plan. It is based upon a system which allows a student who does excellent work in a subject additional credit. The following extract from the University of Missouri Bulletin 1913–14 will elucidate the method:

> In order to encourage students to do the best work of which they are capable, the faculties of the college of arts and science and of the school of education credit their work in proportion to the grade received, thus enabling the most industrious students to *graduate in three years*. For each recitation hour for which the grade of excellent is recorded, the student will receive thirty per cent. additional credit. For each recitation hour for which the grade of superior is recorded, he will receive fifteen per cent. additional credit towards graduation.
>
> The faculty further recognizes that those students who are inferior to seventy-five in a hundred, but whose work is not estimated by the teacher as a complete failure, are entitled to some credit. Students will, therefore, be given four fifths of the normal credit towards graduation for each recitation hour for which the grade of inferior is recorded.
>
> In order to do entire justice to the needs of the students coming to the University of Missouri, the faculty adopts the method of instruction to the students of average ability. Those who are of somewhat less ability will thus receive some benefit from the instruction and some credit. Those who are of superior ability and will devote their best energies to their work will accomplish much more than the average student, and will be given for this, not empty honors, but recognition of their accomplishments by additional credit.

There is one letter which attacks the general elective system. In this letter the writer says that he has been opposed to the free elective system. His "contention has been that the undergraduate should be free to select his own aim, such as law, medicine, commerce or engineering; but that we should prescribe the program of work for its attainment." "Your letter," this professor says, "gives one a new incentive for a renewal of the contest; but this time for a three-year program."

Personally I believe in this stand on the subject of electives. I believe there should be a very definite program outlined for each student who has chosen his field—not a time schedule, but a subject schedule—in which there shall be some space for electives. And I believe, as I have said elsewhere,[1] that the earlier in the educational career of a student this schedule can be put in force, the better. There is too much to be known in all professions to waste time in indeterminate grazing.

The letters from professors, all from heads of departments, are as strong as those already quoted. In almost every instance the writers insist upon thoroughness and upon essentials rather than time consumed. Every one insists (though indirectly in certain cases) that three years of college work is the least in which the average man can obtain the essentials of medical preparation and the other things which, while not essential for medical practise, are essential for breadth and wide understanding. It was this thing that I have called breadth which made our fore-

[1] *Lancet-Clinic*, 1914.

runners in medicine what they are to us. Without a wide and deep social vision the doctor of the future will not be what he should be. Medicine is becoming more and more social. Its function is becoming more and more one of prevention. And a deeper insight into human nature, and a keener understanding of all the sciences, particularly the biologic, will be demanded of the man who will succeed.

PAUL G. WOOLLEY
UNIVERSITY OF CINCINNATI

PROFESSOR THEOBALD SMITH AND A NEW OUTLOOK IN ANIMAL PATHOLOGY

THE recent announcement of an additional endowment to the Rockefeller Institute for Medical Research, for the establishment of a department of animal pathology, marks a far-seeing and helpful recognition of the importance of a phase of research now scantily supported, yet full of promise for the physical and economic welfare of mankind and the well-being of animalkind also. But as the success of such an undertaking is after all more a matter of men than of money, the news that the projected department is to be organized and conducted by Professor Theobald Smith, of Harvard University, is of the happiest augury.

Though long in the foremost rank of the notables of science in America, the work of Professor Smith has not often secured, or suffered, popular exposition. But he has had the uncommon satisfaction of seeing, many times, the lines of thought and research which he has opened lead sooner or later to far-reaching theoretical development and practical achievements.

Thus while Dr. Smith was yet a subordinate in the Bureau of Animal Industry in Washington, he had occasion to study the Texas fever of cattle, then the cause of great economic loss to the farmers and cattle-men of that as well as other states, and of countries the world over. He found at last that the disease was incited by a protozoan parasite so small that it found a spacious abode within the purlieus of a single red cell of the blood, which it ruthlessly destroyed.

Smith and Kilborne announced also that this piroplasma, as it was called, is conveyed from animal to animal through the intervention of a cattle tick in which the protozoan undergoes a developmental cycle upon which the perpetuation of its kind depends. They further learned that cattle recovered from the fever had become immune, and though well, might indefinitely carry the piroplasma in the blood and be a perpetual source of infection for cattle fresh from another district.

This surprising, unprecedented, and, as it seemed to many at the time, unnecessarily complex and rather preposterous mode of infection made good its claims, and Texas fever leads the line of infectious diseases in men and animals, in which some insect acts as intermediary host and sole conveyancer of infective microbes from their sources to fresh victims. Thus in malaria and in yellow fever it is the mosquito which is to blame, and its suppression in any country insures virtual emancipation from these diseases. Thus have Cuba and Panama been rescued, and the way is open for the control of other tropical infections in other lands. Thus also the infective agents of plague and typhus and other communicable maladies are harbored and dispersed by insects which are the vulnerable links in the chain of infection often most easily broken through sanitary control.

The story of all these practical achievements in disease prevention through the knowledge and control of insect pests, leads back twenty years and more to the hot and gloomy garret in Washington, then the laboratory of the Bureau of Animal Industry, and to Dr. Smith's parasitic cattle tick harboring its own invisible protozoan parasite. And Texas fever no longer exacts its toll from man or beast; or if it does it is the man's fault. These immune cattle, bearers of the, to them, innocuous parasite, head the procession of "carriers" of infective agents, in which humans are now known to hold a conspicuous place, and are the bugbears of preventive medicine to-day.

Almost as soon as Koch had shown the world how easily and accurately to cultivate bacteria, more than thirty years ago, in the very